ELECTROCHEMICAL CONVERSION of BROWN COAL (Victoria Brown Coal) into SOLUBABLE FUMIC ACID DERIVATIVES BY USING SMALL ZAPPI CELL FOR BIO-GASIFICATION PROCESS

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For the production of methane gas from low rank coal, the combination of two different technologes such as electrooxidation and fermentation processes has been investigated. First, low rank coals are oxidatively converted into soluvable fumic acid derivatives which was further allowed to convert into methane gas by employing a
methane gas fermentation process. The objective of the work conducted at ICC was the electrooxidative convertion of samples of coal into an electrooxidatively more-functionalized coal suspension, which undergoes further fermentation operation in different laboratory. The electrochemical oxidation of the low rank coal was carried out by using the Zappi cell supplied by the Electrosynthesis Company, Inc. in USA. The above projects have been attempted by the partnership between Nippon Kokan Techno Service Co., Ltd., The Tokyo Institute of Technology, The Institute of Creatve Chemistry, and The Electrosynthesis Company, Inc. sponsored by NEDO (New Energy and Development Organization) of Japan.

Outline of Research Plans

1. Confirmation of Electrolysis Conditions in Zappi-Cell
2. Choice of Electrolytes for Low Rank Coal (LRC) in Zappi-Cell
3. Effect of pH under Electrooxidation of LRC with Zappi-Cell
4. Oxidation Efficiency in Zappi-Cell under Different Electrodes
5. Factors for Generation of Oxidatively Active Species
5. Novel Electrooxidation System for Low Rank Coal by Zappi-Cell

The modification of the coal proceeds by an electrooxidative process: generally, the oxidation may occur on the surface of the anode electrode (direct oxidation) or by the action of a mediator that is produced at the anode and then oxidizes the coal (indirect oxidaiton). Typical mediators could be halide salts, for example. Other oxidizing species are those produced by oxidation of water, and they include: oxygen, O_2; ozone, O_3; hydrogen peroxide, H_2O_2; hydroxyl radicals, OH

Experimental Section

A commercially available Zappi Cell with ca. 70 cm^2 total anode area was used. The Zappi Cell is a open-design electrolysis cell, patented by The Electrosynthesis Company. Typical electrolysis conditions are presented in the folloing Table. The detail results are discussed in the
meeting.

Electrooxidation of Victoria Low Rank Coal

Experment No.	Run 1	Run 2	Run 3
quantity g	5.04	5.08	9.92
Pretreatment	Non-Treatment	Mortar Atomization	Mortar Atomization
Water Used L	1	1	1
Electrolyte			
KH_2PO_4 g	2.5	2.5	2.5
Na_2HPO_4 g	5.0	5.0	5.0
Voltage V	6,9～10.0	6,2～8.6	7.1～9.2
Current A	24,2～30.0	30.0	30.0
Reaction Time h	9.0	6.0	7.0
pH	6,95～7.26	7.04～7.21	6.84～7.12
Temp. ℃	27.7～58.1	24.2～53.6	25.2～54.1
Stile of Sample	Solid Foam Suspension	Solid Foam Suspension	1LPE bottle aq. solution
Remarks			

i) Suspended Low R. Coal solution : 5g/L
ii) Aomization is performed in mortar.